

fabricating a copper (Cu) bond pad from the interconnect material;

depositing a homogenous tantalum (Ta) layer onto the substrate and over the copper (Cu)

bond pad;

patterning and etching the tantalum (Ta) layer, the tantalum (Ta) layer encapsulating the

copper (Cu) bond pad; and

bonding an aluminum (Al) wire to the tantalum (Ta) layer over the bond pad; and

wherein a portion of the tantalum (Ta) layer forms an intermetallic bond with the copper (Cu) bond pad, and another portion of the tantalum (Ta) layer forms a tantalum aluminide ( $TaAl_3$ ) compound to intermetallically bond the aluminum wire to the tantalum (Ta) layer.

#### REMARKS/ARGUMENTS

The Applicants respectfully request reconsideration of this Application in view of the foregoing amendment and the following remarks. The Applicants originally submitted Claims 1-20 in the Application. Pursuant to a restriction requirement, the Applicants previously canceled Claims 16-20 without prejudice or disclaimer. The Applicants also previously added Claim 21. The Applicants presently amend Claim 1, and do not cancel or add any claims. Accordingly, Claims 1-15 and 21 are currently pending in the Application.

## **I. Rejection of Claims 10 and 14 under 35 U.S.C. §102**

The Examiner has rejected Claims 10 and 14 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 4,622,576 to Buynoski. However, Buynoski fails to disclose encapsulating a bond pad with a homogenous metal passivation layer, as recited in Claim 10. In contrast, Buynoski discloses a second layer 22 formed over only a portion of an underlying metal layer 14, as clearly shown in Fig. 2. Therefore, the second layer 22 does not encapsulate the metal layer 14 because a vapox layer 20 and a silicon nitride layer 21 interpose significant portions of the second layer 22 and the metal layer 14. (see Fig. 2).

Accordingly, Buynoski fails to disclose each and every element of Claim 10. Therefore, Buynoski fails to anticipate Claim 10 and its dependent Claims. Consequently, the Applicants request the Examiner withdraw the §102 rejection of Claims 10 and 14.

## **II. Rejection of Claims 1-9, 11-13, 15 and 21 under 35 U.S.C. §103**

The Examiner has rejected Claims 1-9, 11-13, 15 and 21 under 35 U.S.C. §103(a) as being unpatentable over Buynoski in view of U.S. Patent No. 6,187,680 to Costrini, *et al.* ("Costrini") and Electronic Packaging and Interconnection Handbook, by Harper ("Harper"). However, as discussed above, Buynoski fails to teach encapsulating a bond pad with a homogenous metal passivation layer, as recited in Claim 10 and analogously in Claim 1. Buynoski also fails to suggest a homogenous metal passivation layer encapsulating an underlying bond pad, because Buynoski only teaches employing the second layer 22 in conjunction with a conventional passivation layer (comprising the non-conductive vapox layer 20 and the silicon nitride layer 21) in order to passivate the underlying

metal layer 14. (see Fig. 2). That is, none of the individual elements taught in Buynoski encapsulate the underlying metal layer 14.

➔ Moreover, Costrini adds nothing to Buynoski because Costrini also fails to teach or suggest encapsulating a bond pad with a homogenous metal passivation layer. In contrast, Costrini only teaches employing an aluminum stack 30 in conjunction with at least a conventional passivation layer (SiO<sub>2</sub> or Si<sub>3</sub>N<sub>4</sub> layer 24) to passivate the underlying wiring 22. (FIG. 4(a) and others). Thus, none of the individual elements taught in Costrini encapsulate the underlying wiring 22.

Furthermore, Harper adds nothing to the combination of Buynoski and Costrini because Harper also fails to teach or suggest encapsulating a bond pad with a homogenous metal passivation layer. In contrast, Harper merely discloses different types of wire bonding techniques, and fails to teach, suggest or even mention employing any individual element to encapsulate an underlying bond pad.

Accordingly, the combination of Buynoski, Costrini and Harper fails to teach or suggest each and every element recited in Claims 1 and 10 of the present application. Therefore, the combination fails to support a *prima facie* case of obviousness with respect to Claims 1 and 10 and their dependent claims. Thus, Claims 1-9, 11-13, 15 and 21 are not obvious in view of any combination of Buynoski, Costrini and Harper. Consequently, the Applicants request the Examiner withdraw the §103 rejection of these claims.



## Conclusion

In view of the foregoing amendment and remarks, the Applicants now see all of the Claims currently pending in this application to be in condition for allowance and therefore earnestly solicit a Notice of Allowance for Claims 1-15 and 21.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "**Version with markings to show changes made.**"

The Applicants request the Examiner to telephone the undersigned attorney of record at (972) 480-8800 if such would further or expedite the prosecution of the present application.

Respectfully submitted,  
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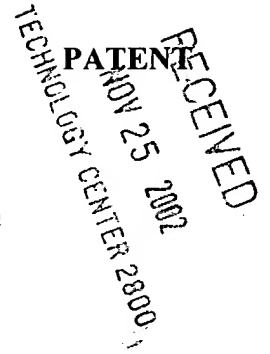
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VERSION WITH MARKINGS TO SHOW CHANGES MADE



IN THE CLAIMS:

Please amend Claim 1 as follows:

1. (Three Times Amended) A wire bonding method, comprising the steps of:  
forming a semiconductor substrate with a copper (Cu) interconnect material;  
fabricating a copper (Cu) bond pad from the interconnect material;  
depositing a homogenous tantalum (Ta) layer onto the substrate and over the copper (Cu)  
bond pad;  
patterning and etching the tantalum (Ta) layer, the tantalum (Ta) layer encapsulating the  
copper (Cu) bond pad; and  
bonding an aluminum (Al) wire to the tantalum (Ta) layer over the bond pad; and  
wherein a portion of the tantalum (Ta) layer forms an intermetallic bond with the copper (Cu)  
bond pad, and another portion of the tantalum (Ta) layer forms a tantalum aluminide (TaAl<sub>3</sub>)  
compound to intermetallically bond the aluminum wire to the tantalum (Ta) layer.